

NASA Tropical Rainfall Measuring Mission (TRMM)

Topic#3: TRMM: El Nino/La Nina

Narrative for TRMM Education Supplement #3

Text and Suggested Support Material for Package:

The coupled atmosphere-ocean phenomenon known as El Niño is frequently followed by a period of normal conditions in the equatorial Pacific Ocean. Sometimes, but not always, El Niño conditions give way to colder-than-normal equatorial Pacific Ocean temperatures. This cold counterpart to El Niño is known as La Niña, Spanish for "the girl child."

It has been found that the recurrent warming and cooling of the equatorial Pacific leaves its distinctive fingerprint on sea level pressure—a phenomenon known as the Southern Oscillation. When the surface pressure between Tahiti, French Polynesia and Darwin, Australia is measured and compared, the difference between the two can be used to generate an "index" number. A high Southern Oscillation Index (SOI) value (large pressure difference) is associated with stronger than normal trade winds and La Niña conditions, while a low SOI (smaller pressure difference) is associated with weaker than normal Trade Winds and El Niño conditions. The Southern Oscillation is analogous to a "seesaw" as surface pressure varies inversely at opposite ends of the equatorial Pacific Ocean. The lowest SOI's ever seen were -39.3 in May 1986, -36.7 in April 1905, -34.2 in February 1983, and -30.7 in December 1940, all El Niño events. The highest values ever seen were 32.3 in April 1917, 30.4 in November 1973, and 21.3 in September 1975, all associated with La Niña events. During the 1997/98 El Niño, the lowest SOI value recorded was -24. During the 1998/99 La Niña, the highest SOI value recorded was 17.

Changes in global atmospheric circulation patterns accompany La Niña and are responsible for weather extremes in various parts of the world that are typically opposite to those associated with El Niño. At higher latitudes, the effects of La Niña and El Niño are most clearly seen in winter. In the continental U.S. during a typical La Niña year, winter temperatures are warmer than normal in the Southeast and cooler than normal in the Northwest. Additionally, tropical storm activity seems to be enhanced during La Niña years since the jet stream shifts northward in the Atlantic allowing hurricanes to develop. During El Niño episodes, the jet stream is further south and tends to tear developing hurricanes apart.

The Tropical Rainfall Measuring Mission (TRMM) satellite, a joint U.S./Japanese mission, is shedding new light on the phenomenon known as La Niña. TRMM research team members have successfully retrieved sea-surface temperature data from the TRMM Microwave Imager (TMI) instrument onboard the spacecraft. The only spaceborne microwave instrument observing sea-surface temperature in the tropics, TMI sea-surface data is providing scientists with new insight into the complex evolution of La Niña. The images show changes in sea-surface temperature, ocean current movement, the dissipation of El Niño, and the onset of La Niña. In fact, TRMM was one of the first space-based sensors to observe the onset of the 1998 La Niña.

Knowledge of La Niña is not as mature as that for El Niño. For example, every strong El Niño is not necessarily followed by a La Niña. Scientists are performing advanced studies of El Niño and La Niña using information obtained from satellites in space and instruments in the oceans. Quality sea-surface temperature data via a microwave scanner has been a long term aspiration among oceanographers since the last microwave imager ceased operations more than a decade ago. In addition, none of the previously existing microwave scanners had the capability of TMI. Ideally, the information obtained from TRMM's Microwave Imager will be used to study anomalous weather patterns and ocean currents leading to the improvement of weather forecasting.